Understanding and Simulation of the Effects of Vegetation on North American Monsoon Precipitation

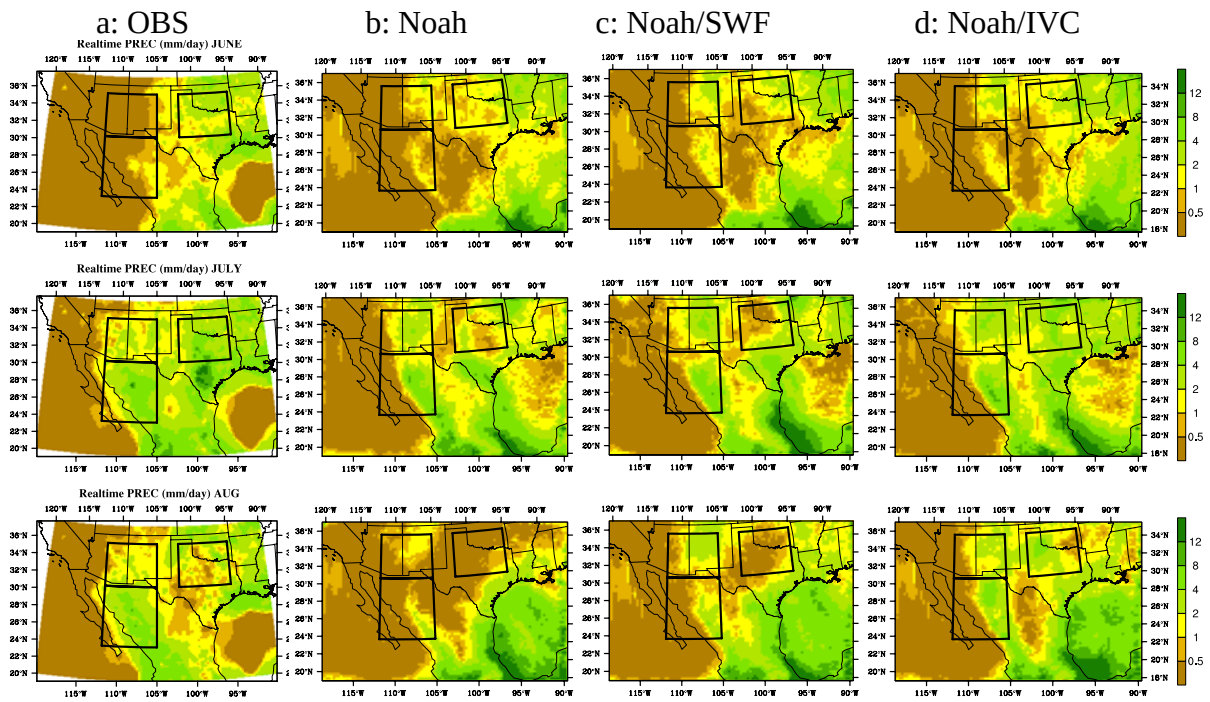

Figure 1 (a) The observed monthly rainfall (mm/day) for June, July, and August, (b) monthly rainfall from WRF coupled with Noah, (c) monthly rainfall from WRF coupled with Noah, but the root water uptake factor is modified according to the method described in the text, and (d) monthly rainfall from WRF with Noah but both SWF and IVC are included.

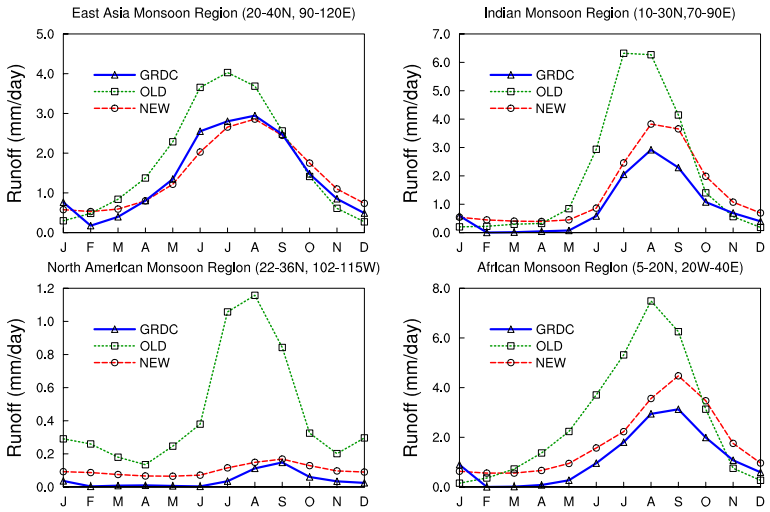

Figure 2. Simulated runoff from SIMPTOP (NEW) and from the baseline runoff scheme is compared to the GRDC (Global Runoff Data Center) runoff in four main monsoon regions.

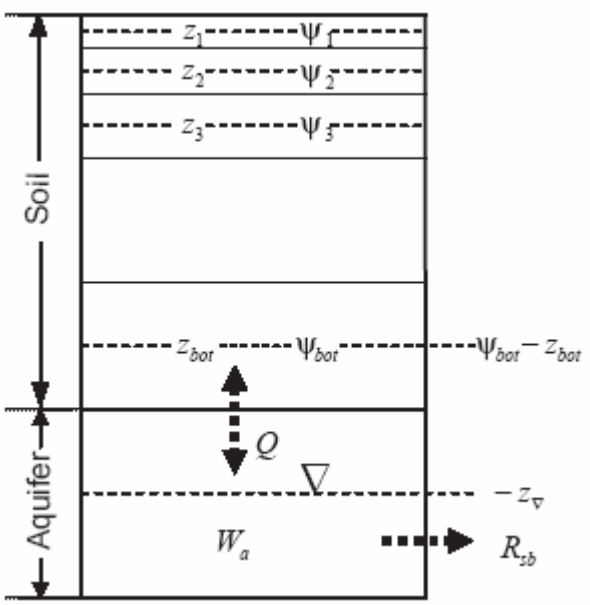

Figure 3. Schematic diagram of the soil layers and an unconfined aquifer. The depth to water table is represented by z_∇. The recharge rate, Q, is proportional to the difference between the water head at the bottom layer ($\psi_{bot} - z_{bot}$) and that at the water table ($-z_\nabla$).

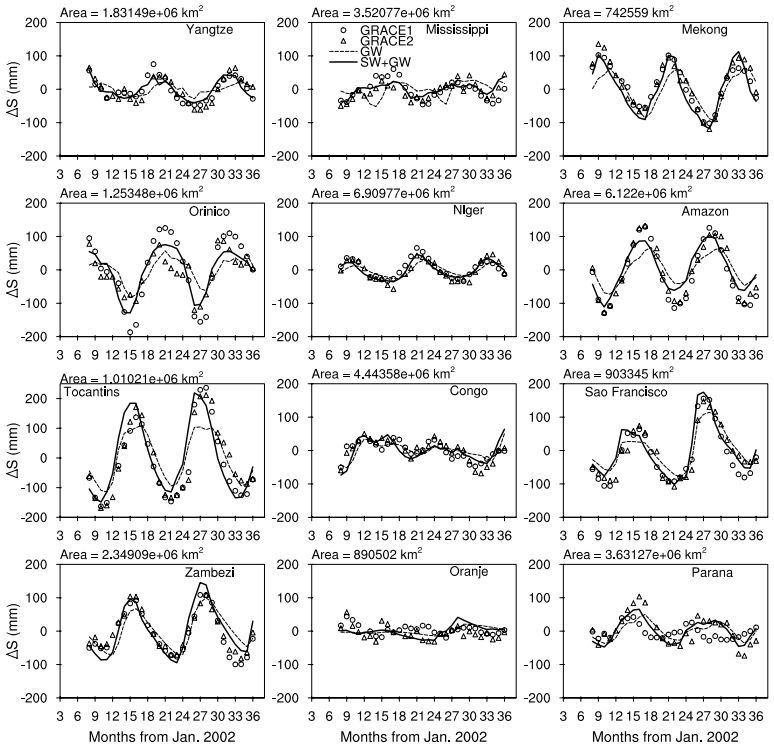

Figure 4. Modeled river-basin averaged anomalies of the total water storage (unsaturated soil water + groundwater: SW+GW, except for Mississippi, where snow water is also included) and groundwater storage (GW) in comparison with GRACE water storage anomaly.

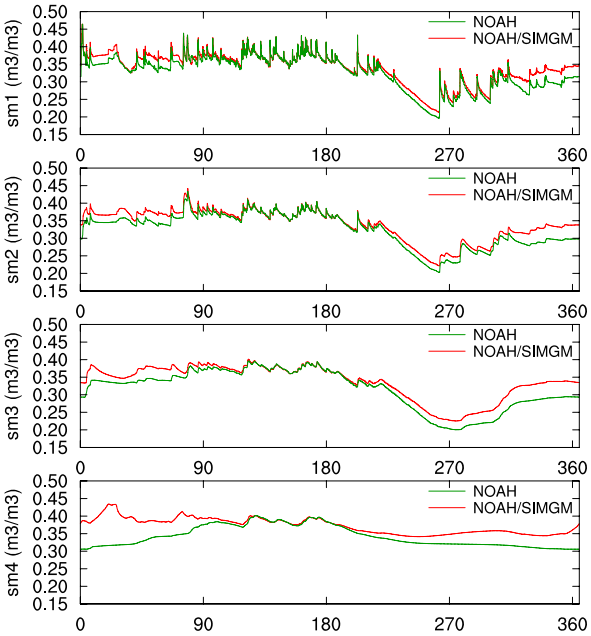

Figure 5. Modeled soil moisture in four soil layers (0.1, 0.3, 0.6, and 1.0m) by Noah without and with SIMGM.

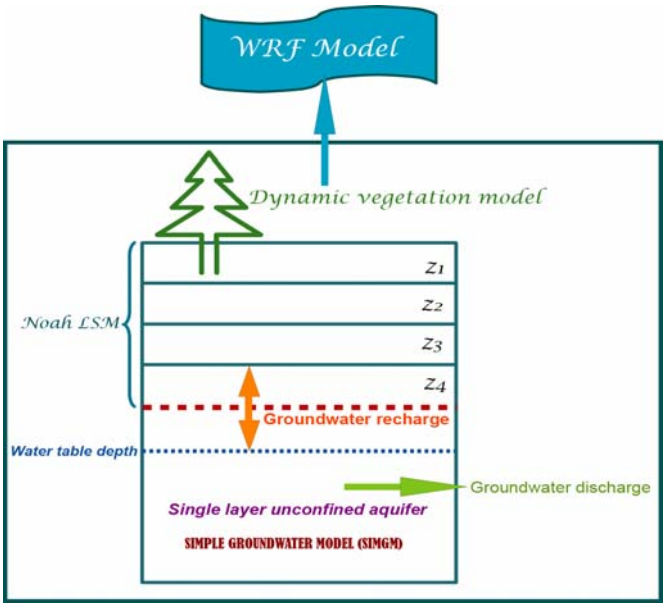

Figure 6. Noah LSM coupled with a dynamic vegetation and groundwater components

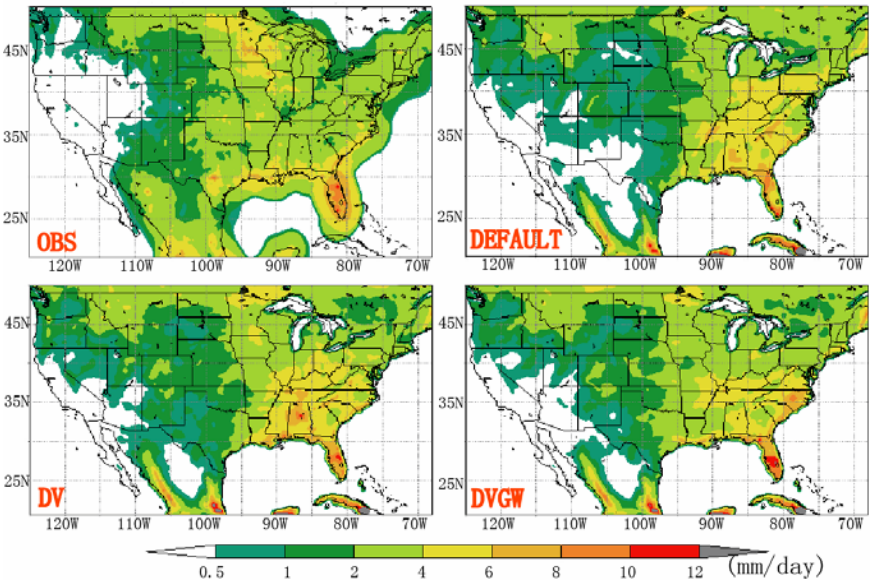

Figure 7. Precipitation (mm/day) in July 2002. (a) Observations, (b) WRF with the standard Noah LSM (FIX) (c) As (b) but including an interactive vegetation canopy (D)

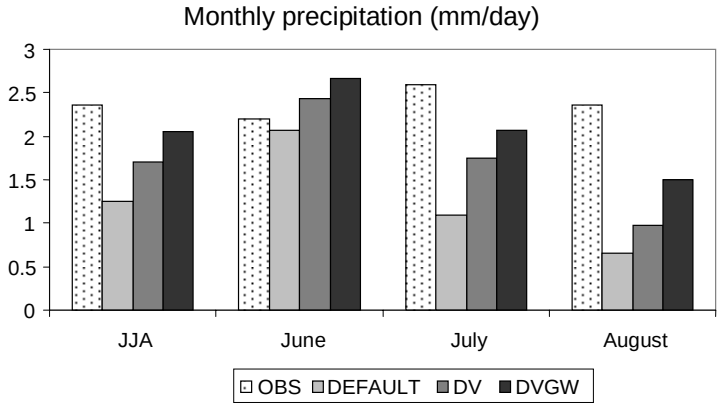

Figure 8. Simulated and observed monthly mean precipitation in the Central United States.

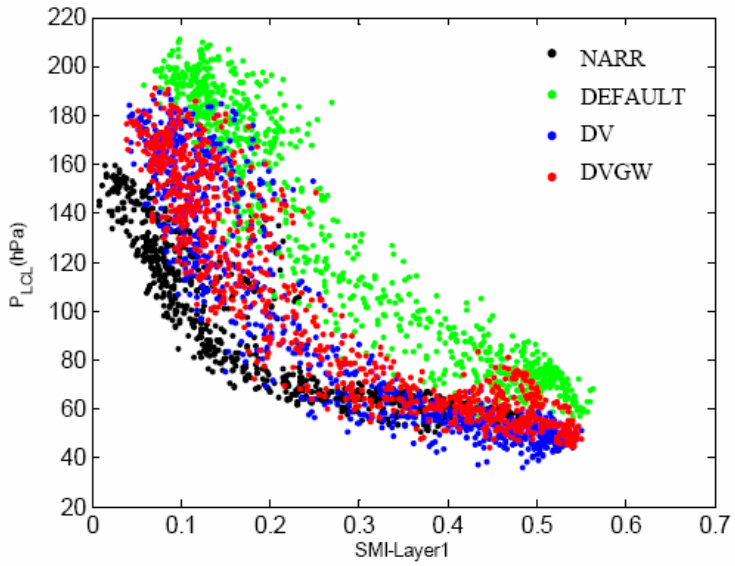

Figure 9. The relationship between lifting condensation level (LCL) with the degree of saturation of surface soil moisture.